

SITE QA PROJECT PLAN
WEST MAHOPAC GROUNDWATER CONTAMINATION
WEST MAHOPAC, PUTNAM COUNTY, NEW YORK

Prepared by

Superfund Technical Assessment and Response Team
Roy F. Weston, Inc.
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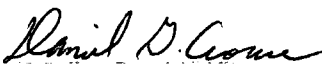
Prepared for

U.S. Environmental Protection Agency
Region II - Emergency & Remedial Response Division
Edison, New Jersey 08837

DCN #: START-02-F-03886
TDD #: 02-99-10-0011
EPA Contract No.: 68-W5-0019

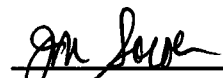
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The following elements are provided in the START Generic Quality Assurance Project Plan (QAPP) and are included by reference:

QA REPORTS TO MANAGEMENT
PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES
RECORDS MANAGEMENT SYSTEM
LOGBOOK PROGRAM
QUALITY-RELATED DOCUMENTS
INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

LIST OF ATTACHMENTS

ATTACHMENT A: Site Location Map

ATTACHMENT B: Sampling Standard Operating Procedures

1.0 INTRODUCTION

Presented herein is the site Site Quality Assurance (QA) Project Plan (QAPP) for the sampling event to be conducted on November 4, 1999 at the West Mahopac Groundwater Contamination Site by the Region II Superfund Technical Assessment and Response Team (START). The site sampling plan has been developed at the request of the United States Environmental Protection Agency (U.S. EPA) in accordance with the START Generic Quality Assurance Project Plan (QAPP).

The sampling strategy listed within this plan emphasize the collection of samples required to evaluate certain pathways of concern to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Program. This Sampling QAPP provides a description of the West Mahopac Groundwater Contamination Site and an evaluation of site conditions to determine if further action is warranted for the site. The analytical data generated from the sampling effort will also be utilized to provide additional information to evaluate whether the newly installed treatment systems at six residences are effectively treating the groundwater to below the MCLs for the contaminants of concern and to aid the U.S. EPA On-Scene Coordinator (OSC) in determining future EPA Removal Action activities.

This plan is based on information currently available and may be modified on site in light of field screening results and other acquired information. All deviations from the Sampling QAPP will be noted in the Sampling Trip Report.

2.0 PROJECT DESCRIPTION

The West Mahopac Groundwater Contamination Site consists of contamination in private residential wells along Secor Road and Parkway Road near West Mahopac, Putnam County, New York. A Site Location Map, which identifies the area of concern, is presented in Figure 1 (Attachment A).

On 7 - 9 September, 1999, START II members collected groundwater samples from approximately 25 residences from the West Mahopac Site. The samples were analyzed for volatile organic compounds (VOCs). Trichloroethene (TCE) was detected in groundwater samples collected from several of the residences up to an estimated concentration of 980 J ug/L; cis-1,2-dichloroethene (cis-1,2-DCE) was detected up to 7 ug/L.

At this time, there are no confirmed sources associated with the widespread groundwater contamination; however, there are currently several potential sources which may have contributed to the regional groundwater contamination.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The EPA OSC, Dwayne Harrington, will provide overall direction to the staff concerning project sampling needs, objectives, and schedule. The Project Manager (PM), Sam Getty, will be the primary point of contact with the OSC. The PM is responsible for the development and completion of the Sampling QAPP, project team organization, and supervision of all project tasks, including reporting and deliverables. The Site QC Coordinator will be responsible for ensuring field adherence to the Sampling QAPP and recording of any deviations. The START Analytical Services Coordinator, Smita Sumbaly, will be the primary project team site contact with the EPA Contract Laboratory Program (CLP) coordinator and a subcontracted laboratory, if necessary.

Analyses for target compound list (TCL) volatiles, TCL semi-volatiles, and methyl tertiary-butyl ether (MTBE) shall be performed according to EPA protocol. START will arrange for TCL volatiles and semi-volatiles, and MTBE analyses. START personnel will transfer custody of the samples for shipment to the appropriate laboratory. The data will be validated by the START Analytical Services Group.

The following sampling personnel will work on this project:

| <u>Personnel</u> | <u>Responsibility</u> |
|-------------------|---|
| Dwayne Harrington | Task Manager and Provide Oversight |
| Sam Getty | Project Manager |
| Dan Crouse | Sample Collection and Field Coordinator |

The following laboratories will provide the following analyses:

| <u>Lab Name/Location</u> | <u>Sample Type</u> | <u>Parameters</u> |
|--|--------------------|---|
| Mitkem Corporation 175 Metro Center Boulevard Warwick, RI 02886-1755 401-732-3400 | Aqueous | TCL volatiles, TCL semi-volatiles, and MTBE |

Verbal results will be provided within one week and written results within two weeks.

4.0 DATA USE OBJECTIVES

The objective of this Removal Action is to provide sufficient documentation of the TCL volatile, TCL semi-volatile, and MTBE concentrations in the well water of the six homes to determine if the treatment systems are adequately removing the contaminants. The analytical results will be compared to the MCL for TCE of 5.0 ug/L and cis-1,2-DCE of 7 ug/L. The data will also be evaluated to assess potential risks to human health and the environment from exposure to hazardous substances attributable to the site.

4.1 Quality Assurance Objectives

The overall Quality Assurance (QA) objective for chemical measurement data associated with this sampling event is to provide analytical results that are legally defensible in a court of law. The QA program will incorporate Quality Control (QC) procedures for field sampling, chain of custody, laboratory analyses, and reporting to assure generation of sound analytical results.

The EPA OSC has requested the standard detection limits for the volatile and semi-volatile compounds and MTBE for the project, and a critical level of QA (i.e., QA-2). Details of this QA level are provided below.

The following requirements apply to the respective QA Objectives and parameters identified.

The QA Protocols for a Level 2 QA objective sampling event are applicable to all sample matrices and include:

1. Sample documentation in the form of field logbooks, appropriate field data sheets, and chain of custody records (chain of custody records are optional for field screening locations).
2. Calibration of all monitoring and/or field-portable analytical equipment prior to collection and analyses of samples with results and/or performance check procedures/methods summarized and documented in a field, personal, and/or instrument log notebook.
3. Field or laboratory determined method detection limits (MDLs) will be recorded along with corresponding analytical sample results, where appropriate.
4. Analytical holding times as determined from the time of sample collection through analysis. These will be documented in the field logbook or by the laboratory in the final data deliverable package.

5. Initial and continuous instrument calibration data.
6. QC blank results (rinsate, trip, method, preparation, instrument, etc.), as applicable.
7. Collection and analysis of blind field duplicate and MS/MSD QC samples to provide a quantitative measure of the analytical precision and accuracy, as applicable.
8. Use of the following QC procedure for QC analyses and data validation:

Definitive identification - confirm the identification of analytes on 100% of the critical samples, via an EPA-approved method; provide documentation such as gas chromatogram, mass spectra, etc.

The objective of this project/event applies to the following parameters:

Table 1: Quality Assurance Objectives

| QA Parameters | Matrix | Intended Use of Data | QA Objective |
|---------------------------|----------------|--|---------------------|
| TCL Volatiles | Aqueous | Document contamination of private wells and determine if the treatment systems are adequately removing the contaminants from the well water at the residences. | QA-2 |
| TCL Semi-volatiles | Aqueous | Document contamination of private wells and determine if the treatment systems are adequately removing the contaminants from the well water at the residences. | QA-2 |
| MTBE | Aqueous | Document contamination of private wells and determine if the treatment systems are adequately removing the contaminants from the well water at the residences. | QA-2 |

A Field Sampling Summary is contained in Table 2 and a QA/QC Analysis and Objectives Summary is contained in Table 3. Section 5.1, Sampling Design, provides information on analyses to be performed on the individual samples.

TABLE 2:**FIELD SAMPLING SUMMARY**

| Analytical Parameters | Matrix | Container Size | Preservative | Holding Time ¹ | Subtotal Samples | Trip Blanks ² | Rinsate Blanks ² | Duplicate Samples ² | MS/MSD Samples ³ | Total Field Samples |
|-----------------------|---------|----------------------------|------------------------------|---|------------------|--------------------------|-----------------------------|--------------------------------|-----------------------------|---------------------|
| TCL Volatiles | Aqueous | 40-mL VOA vials (3) | Cool to 4°C, HCl to pH <2 | 7 days, if unpreserved 14 days, if preserved | 6 | 1 | 0 | 1 | 1 | 9 |
| TCL Semi-volatiles | Aqueous | 32-ounce amber jars (1) | Cool to 4°C | 7 days to extraction, 40 days to analysis | 6 | 0 | 0 | 1 | 1 | 8 |
| MTBE | Aqueous | 40-mL VOA vials (3) | Cool to 4°C, HCl to pH <2 | 7 days, if unpreserved 14 days, if preserved | 6 | 1 | 0 | 1 | 1 | 9 |

¹ Holding time from date of sampling.

² Only required if non-dedicated sampling equipment to be used. NR - not required, dedicated sampling equipment to be used.

³ Not required for QA-1 (screening)

TABLE 3**QA/QC Analysis and Objectives Summary**

| Analytical Parameters | Matrix | Analytical Method Reference | QA/QC Quantitation Limits | QA Objective |
|-----------------------|---------|---|---------------------------|--------------|
| TCL Volatiles | Aqueous | SW846 Method 8240 or CLP OLMO 3.3 or equivalent | As per method | QA-2 |
| TCL Semi-volatiles | Aqueous | SW846 Method 8250 or 8270, 8280 or CLP OLMO 3.3 | As per method | QA-2 |
| MTBE | Aqueous | SW846 Method 8240 or CLP OLMO 3.3 or equivalent | As per method | QA-2 |

Note: CLP-format deliverables required for all data packages.

5.0 APPROACH AND SAMPLING PROCEDURES

The following sampling activities will be conducted at the West Mahopac Groundwater Contamination Site:

- Groundwater Sampling (private wells) after the treatment systems.

5.1 Sampling Design

START will sample the groundwater from the wells of six residences after the treatment systems.

The field program will include the collection of groundwater samples from private wells. All sampling activities will be performed by the Region II START, under the direction of the EPA OSC. Groundwater samples will be analyzed for TCL volatiles, TCL semi-volatiles, and MTBE. Samples will be obtained from a faucet in each home due to the anticipated difficulty in gaining access to sealed domestic wells. If water treatment systems are in use, samples will be obtained after the treatment device. If samples are collected at faucets, any aerator device, garden hose, or other attachment will be removed prior to sampling.

5.2 Schedule of Activities

| <u>Proposed Start Date</u> | <u>Activity</u> | <u>End Date</u> |
|-----------------------------------|------------------------|------------------------|
| November 4, 1999 | Private Well Sampling | November 4, 1999 |

5.3 Sampling Equipment

Groundwater samples will be collected from private wells. The water will be collected directly into the appropriate sample bottles; therefore, no sampling equipment will be used.

5.4 Sample Identification System

Each sample collected by Region II START will be designated by the home number and beginning letter of the street name. Specific media types are as follows: TW - Tap (Private Well) Water.

A duplicate sample will be identified in the same manner as other samples. The sample identification will be distinguished and documented in the field logbook. Similarly, MS/MSDs will also be distinguished and documented in the field logbook.

5.5 Standard Operating Procedures (SOPs)

5.5.1 Sample Documentation

All sample documents will be completed legibly, in ink. If errors are made, the error will be crossed out with a single line, initialed and dated.

Field Logbook

The field logbook is essentially a descriptive notebook detailing site activities and observations so that an accurate account of field procedures can be reconstructed in the writer's absence. The sampling team or individual performing a particular sampling activity is required to maintain a field logbook. The logbook shall be filled out at the location of sample collection immediately after sampling. All entries will be dated and signed by the individuals making the entries, and should include (at a minimum) the following:

1. Site name and project number.
2. Name(s) of personnel on site.
3. Dates and times of all entries (military time preferred).
4. Descriptions of all site activities, site entry and exit times.
5. Noteworthy events and discussions.
6. Weather conditions.
7. Site observations.
8. Sample no(s). and sample location identification and description*.
9. Subcontractor information and names of on-site personnel.
10. Date and time of sample collections, along with chain of custody information.
11. Record of photographs, if applicable.
12. Site sketches.

The description of the sample location will be noted in such a manner as to allow the reader to reproduce the location in the field at a later date.

Sample Labels

Sample labels will clearly identify the particular sample, and should include the following:

1. Sample identification number.
2. CLP No., if appropriate.
3. Sample collection date and time.
4. Sample preservation.
5. Analytical parameters.

Custody Seals

Custody seals demonstrate that a sample container has not been tampered with, or opened. The individual in possession of the sample(s) will sign and date the seal, affixing it in such a manner that the container cannot be opened without breaking the seal. The name of this individual, along with a description of the sample packaging, will be noted in the field logbook.

5.5.2 Sampling SOPs

The following Sampling SOPs will be used for this project:

Decontamination

Decontamination of sampling equipment will not be performed. The samples will be collected (directly) in the appropriate sample bottles; therefore, sampling equipment will not be used to collect the potable water samples.

Potable Water Sampling

Potable water sampling activities will be conducted in accordance with guidelines outlined in Weston Sampling SP No. 16-11-012 Potable Water Sampling (Attachment B).

Samples will be obtained from a faucet in each home due to the anticipated difficulty in gaining access to sealed domestic wells. If water treatment systems are in use, samples will be obtained when possible before the treatment device, as well as before any aerator device, garden hose or other attachment.

The following procedures apply to the collection of residential well groundwater samples:

1. Wear protective gear as specified in the Health and Safety Plan. Samplers shall don new outer sampling gloves prior to sampling at each location.
2. Inspect the well including pump, storage tanks, and any treatment systems present.
3. Sample access point should be chosen as close to the well head as possible prior to the water entering any storage tank or treatment systems.
4. If the volume of purged water cannot be determined, the well will be evacuated for a minimum of 15 minutes. If the volume can be calculated, a minimum of 3 to 5 well volumes should be purged unless the well is in continuous use. If the well is used for industrial production, the pumping rate should be noted as such, and the tap for sampling purged for 15 minutes. An outside faucet may be used for purging.

5. Record sample number, date, time, flow rate, treatment type (and location of unit, if present), location sample collected, depth of well, lot and block No(s), residents name, address (and mailing address, if different from address), and the sampler(s) name in the field logbook. Also, note in the logbook if the sample is a QA/QC sample [e.g., duplicate or matrix spike/matrix spike duplicate (MS/MSD)].
6. Samples will be obtained by collecting the water directly from the access point into the sample container.
7. The preservation procedure shall be as follows:
 - a) for TCL volatiles and MTBE, preserve the 40-mL VOA bottles with HCl, and fill each container as required in Table 2. The amount of HCl required for each sample will be determined prior to collecting the sample.
8. Place samples in cooler and chill with ice. Samples will be hand-delivered, picked up (by the laboratory), or shipped within 24 hours of collection to the designated laboratories.
9. Complete sample labels, custody seals, and chain of custody forms.

This sampling design is based on information currently available and may be modified on site in light of field screening results and other acquired information. All deviations from the sampling plan will be noted in the Sampling Trip Report.

5.5.3 Sample Handling and Shipment

Chain of custody forms, sample labels, custody seals, and other sample documents will be completed as specified in the above reference manual. All entries will be made in permanent ink. If errors are made when completing any of these forms, the error will be crossed out with a single line, initialed, and dated by the sampler. Each environmental sample will be properly identified and sealed in a polyethylene bag. The bag shall then be placed in a plastic cooler which has also been lined with a large polyethylene bag. When required, samples shall be packed with sufficient ice (sealed in polyethylene bags) to cool the samples to 4°C. Sufficient non-combustible, adsorbent cushioning material shall be placed in the cooler so as to minimize the possibility of container breakage. All sample documents will be sealed in a plastic bag and affixed to the underside of each cooler lid. The large plastic bag shall then be sealed and the container closed. The lid will be sealed and custody seals and strapping tape shall then be affixed to the outer packaging so that any sign of tampering is easily visible. All packaging will conform to International Air Transport Association (IATA) regulations for overnight carriers. Sample shipment will conform to Roy F. Weston, Inc., Guidelines for Classifying Field Sample Shipments and the most current IATA Dangerous Goods Regulations. All samples will either be hand-delivered or shipped via common carriers to the laboratory within 24 hours of collection.

5.6 Sample Containers

Sample bottles will be obtained from qualified vendors via a competitive bid process and will meet all guidelines specified in OSWER Directive 9240.0-05A, Specifications and Guidance for Contaminant-Free Sample Containers (July 1989).

5.7 Disposal of PPE and contaminated sampling materials

All used PPE and disposable sampling equipment will be disposed of at the EPA facility in appropriate trash receptacles. No equipment will be disposed on site.

6.0 SAMPLE CUSTODY

A Chain of Custody record will be maintained from the time the sample is collected to its final disposition. Every transfer of custody must be noted and signed for, and a copy of this record kept by each individual who has signed. When samples (or groups of samples) are not under direct control of the individual responsible for them, they must be stored in a locked container sealed with a custody seal. Specific information regarding custody of the samples projected to be collected on the weekend will be noted in the field logbook.

The chain of custody record should include (at minimum) the following:

1. Sample identification number.
2. Sample information (e.g., matrix, concentration, type, preservation).
3. Analysis(es).
4. Sample date and time.
5. Name(s) and signature(s) of sampler(s).
6. Signature(s) of any individual(s) with control over samples.

A separate chain of custody form must accompany each cooler for each daily shipment. The chain of custody form must address all samples in that cooler, but not address samples in any other cooler. This practice maintains the chain of custody for all samples in case of mis-shipment.

7.0 FIELD INSTRUMENT CALIBRATION AND PREVENTIVE MAINTENANCE

The sampling team is responsible for assuring that a calibration/maintenance log will be brought into the field and maintained for each measuring device. Each log will include at a minimum, where applicable:

1. name of device and/or instrument calibrated
2. device/instrument serial and/or ID number
3. frequency of calibration
4. date of calibration
5. results of calibration
6. name of person performing the calibration
7. identification of the calibration instrument (PID, FID, pH meter)

Equipment to be used each day will be calibrated prior to the commencement of daily activities.

8.0 ANALYTICAL METHODS

Analytical methods to be utilized in the analyses of samples collected during this sampling event are detailed in Table 3.

9.0 DATA REDUCTION, VALIDATION AND REPORTING

9.1 Deliverables

The START PM, Sam Getty, will maintain contact with the EPA OSC, Dwayne Harrington, to keep him informed about the technical and financial progress of this project. This communication will commence with the issuance of the work assignment and project scoping meeting. Activities under this project will be reported in status and trip reports and other deliverables (e.g., analytical reports, trip reports) described herein. Activities will also be summarized in appropriate format for inclusion in monthly and annual reports.

The following deliverables will be provided under this project:

Trip Report

A trip report will be prepared to provide a detailed accounting of what occurred during each sampling mobilization. The trip report will be prepared within one week of the last day of each sampling mobilization. Information will be provided on time of major events, dates, and personnel on site (including affiliations).

Maps/Figures

Maps depicting site layout, potential contaminant source areas, and sample locations will be included in the trip report, as appropriate.

Analytical Report

An analytical report will be prepared for samples analyzed under this plan. Information regarding the analytical methods or procedures employed, sample results, QA/QC results, chain of custody documentation, laboratory correspondence, and raw data will be provided within this deliverable.

Data Review

A review of the data generated under this plan will be undertaken. The assessment of data acceptability or useability will be provided separately, or as part of the analytical report.

9.2 Data Validation

For QA-2 projects:

Data generated under this QA/QC Sampling Plan will be evaluated according to criteria contained in the Removal Program Data Validation Procedures that accompany OSWER Directive number 9360.4-1 and in accordance with Region II guidelines.

Laboratory analytical results will be assessed by the data reviewer for compliance with required precision, accuracy, completeness, representativeness, and sensitivity

Analytical results obtained will be validated by START in accordance with the most current USEPA Region II data validation guidelines.

10.0 FIELD QA/QC CHECK SAMPLES AND FREQUENCY

This section details the Quality Assurance/Quality Control (QA/QC) requirements for field activities performed during the sampling effort.

QA/QC samples will include the collection of one field duplicate and one MS/MSD sample for each matrix (water) at a ratio of 1 per 20 samples (for QA-2). The extra sample volume will be submitted to allow the laboratory to perform matrix spike sample analysis. This analysis provides information about the effect of sample matrix on digestion and measurement methodology. Field duplicate samples provide an indication of analytical variability and analytical error (e.g., reproducibility) and will not be identified to the laboratory.

A trip blank will be collected for events involving aqueous sampling for VOCs. A trip blank is an aliquot of deionized (DI) demonstrated analyte-free water which is prepared in the field prior to the initiation of field work and sealed in 40-mL glass vials with Teflon-lined septum caps. Analytical results of the trip blank sample are utilized during sample data validation to determine if any cross contamination has occurred between samples during shipment/storage, or if on-site atmospheric contaminants are seeping into the sample vials. These sealed bottles will be placed in a plastic cooler and will accompany field personnel to the sampling locations.

The distilled deionized (DI) water utilized for the trip blanks will be certified as such. A copy of this certificate will be kept on site and another in the site-specific project file. The criteria to be demonstrated as analyte-free will be consistent with that specified in the U.S. EPA Region II CERCLA Quality Assurance Manual (October 1989), and is as follows:

Purgeable organics < 10 ppb
Inorganics < CRDL

where the CRQL is represented by the Contract Required Quantitation Limit and the CRDL is represented by the Contract Required Detection Limit in the most recent CLP Statement of Work. For specific common laboratory contaminants such as methylene chloride, acetone, toluene, and 2-butanone, the allowable limits are three times the respective CRQLs.

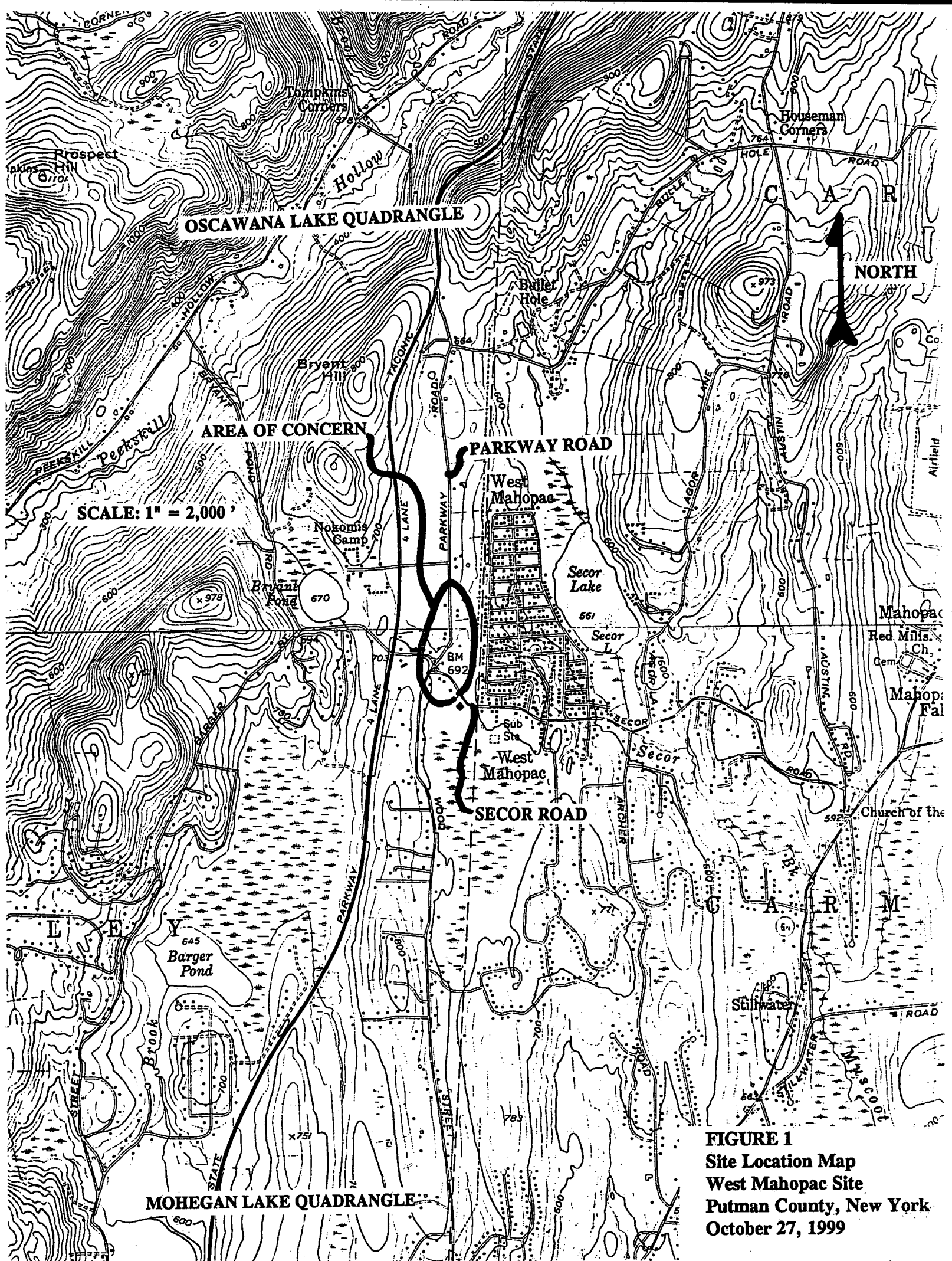
11.0 SYSTEM AUDIT

The Field QA/QC Officer will observe sampling operations and review subsequent analytical results to ensure compliance with the QA/QC requirements of the project/sampling event.

12.0 CORRECTIVE ACTION

All provisions will be taken in the field and laboratory to ensure that any problems that may develop will be dealt with as quickly as possible to ensure the continuity of the project/sampling events. Any deviations from this sampling plan will be noted in the final report.

ATTACHMENT A
SITE LOCATION MAP



ATTACHMENT B
SAMPLING STANDARD OPERATING PROCEDURES



Eff. Date: 04/01/93 Initiated By: R.B. Biggs

Approved By: P.J. Marks

Authorized By: A.M. Henry

SP No.:

16-11-012

POTABLE WATER SAMPLING

THE APPROVAL SIGNATURES ARE KEPT ON FILE
WITH WESTON'S POLICIES AND PRACTICES GROUP
OF THE QUALITY ASSURANCE/FINANCE DIVISION

REVISION NUMBER: 00

Initiated by: D.L. Jones
R.B. Biggs
Legal Review: D.B. Bauer
Approved by: P.J. Marks
Authorized by: A.M. Henry

Important Notice:

This document has been prepared as a default procedure to assist Roy F. Weston, Inc. (WESTON) personnel with the performance of specific task and procedures when other guidance documents or regulatory procedures are not applicable or are non-existent. It is the sole responsibility of WESTON personnel performing procedures in this operating practice to determine if other guidance documents or regulatory procedures exist and are to be followed instead of or in conjunction with this operating practice. Other guidance or regulatory documents can include, but are not limited to Federal, State, and Local codes, policies, client or WESTON proposals, work plans, field sampling plans, quality assurance project plans, and any other applicable document. This document is not to be utilized by WESTON personnel as a substitute for thorough understanding of the subject matter or as a substitute for applicable training.

1.0 PURPOSE

Roy F. Weston, Inc. (WESTON) has adopted New Jersey Department of Environmental Protection and Energy (NJDEPE) standard for potable water sampling and domestic well sampling (see attachment).

2.0 INTERPRETATION

If there are questions regarding the interpretation or the applicability of items in this operating practice, the Project Manager or Technical Manager should be consulted. In the absence of either of those, contact your Section Manager.

3.0 REFERENCES

New Jersey Department of Environmental Protection and Energy (NJDEPE) Field Sampling Procedures Manual, May 1992, pages 181-186.

Measurement of the thickness of the floating layer may be accomplished by using a water indicator paste/gel with a weighted steel tape to determine the depth to the top of the floating layer and to the water surface. The difference between these two readings is the thickness of the floating layer. Measurement of the thickness of the floating layer may also be accomplished by using an interface probe or clear Teflon bailer, if the product thickness is less than the length of the bailer. Electric water level sounders will not work properly for these determinations.

Prior to the purging of ground water from the well, a sample of the floating layer may be obtained using a bailer which fills from the bottom. Care should be taken to lower the bailer just through the floating layer but not significantly down into the underlying ground water. Samples should be analyzed to determine the chemical composition of the LNAPL and its physical properties (e.g., specific gravity, water solubility, equilibrium vapor pressure of the liquid and Henry's Law Constant, etc.). After following typical evacuation procedures discussed previously in this section, a sample of formation water may be obtained from the well.

g. Sampling for Dense, Non-Aqueous Phase Liquids (DNAPLs)

DNAPLs include chlorinated solvents and other chemicals which have specific gravities greater than water. They are likely to be present in aquifers as a separate phase because of low solubility in water. DNAPL chemicals tend to migrate downward through the unsaturated zone and the saturated zone due to their high density. If the volume of DNAPL chemical introduced into the subsurface is larger than the retention capacity of the vadose and saturated zones, a portion of the DNAPL will spread out as a layer of free liquid on the bottom of the aquifer or on lower permeability beds within the aquifer.

Measurement of the thickness of DNAPLs (and LNAPLs) must be performed prior to purging (evacuating) the well. Measurement of the DNAPL may be accomplished by using a water indicator paste/gel with a weighted steel tape (if no LNAPL is present) to determine the depth of the top of the DNAPL and the bottom of the well. The difference between these two measurements is the thickness of the DNAPL in the well. An interface probe may also be used to measure DNAPL in the well. An interface probe may also be used to measure DNAPL

thickness.

Prior to purging a monitor well, a sample of the DNAPL may be obtained using a dual check valve bailer or a bladder pump. If both LNAPLs and DNAPLs are present in a well it may be necessary to purge the well of one casing volume of water prior to sampling the DNAPL provided that efforts are made not to disturb the DNAPL in the bottom of the well. This can be accomplished by setting the pump intake of the submersible or suction-lift pump several feet above the DNAPL.

Samples should be analyzed to determine the chemical composition of the DNAPL and its physical properties (e.g., specific gravity, water solubility, equilibrium vapor pressure of the liquid and Henry's Law Constant, etc.). After the well is purged, a sample of the ground water may be obtained for laboratory analysis.

h. Sampling Domestic Wells

(See also, J. "POTABLE WATER SAMPLING" -
2. "INDIVIDUAL WATER SUPPLY SYSTEMS")

An important step in sampling a domestic well is to obtain as much information as possible from the homeowner. This should include: depth of the well, well yield, formation in which the well is completed, screen depth and length, well construction material, diameter of casing and when and by whom the well was installed. This information should be verified if possible by obtaining drilling logs, etc. With this information, determine the number of gallons to be evacuated (see section 5. "Sampling Procedures" b. "Field Measurements").

When collecting a sample from an operating domestic well, it is essential to evacuate the plumbing and water storage tank. Running the water for a minimum of fifteen minutes before collection is a good rule of thumb, however, longer is desirable. Listen for the pump or the electric circuit to the pump to come on, indicating that the plumbing is being evacuated. Inquire as to whether any treatment units are installed on the system. Softening, iron removal, turbidity removal, disinfection, pH adjustment are often used; these may give misleading analyses depending on the parameters of interest. Home carbon filters for the removal of organics are also increasingly popular. Basement and outside faucets may by-pass such treated water (note: sample cold water faucet).

A brief inspection of the system should be performed to locate the well, pump, storage tanks and any treatment systems. Samples should be taken as close to the pumping well as possible and prior to any storage tanks or treatment systems. If a sample must be taken following a treatment unit, the type, size and purpose of the unit should be noted on samples sheets and in the field logbook.

Home faucets, particularly kitchen faucets, usually have a screen installed on the discharge. The screen must be removed prior to sampling for bacteria, or for volatile organics, since the screen tends to aerate the water and some organics may be lost. Also, when sampling for bacteria, do not take a sample from a swivel faucet since the joint may harbor a significant bacterial population.

Note: Homeowners' plumbing systems should not be tampered with in any way, except for removal of the faucet screen with permission of the homeowner.

For long term monitoring projects which utilize domestic wells, a specific tap or faucet should be designated as the target sample access point for accurate reproducibility of future samples.

i. Sampling Industrial Wells

When sampling industrial wells, it is desirable to sample as close to the well source as possible. Samples should be taken directly from the well head whenever possible. This will eliminate treatment interferences, possible changes in quality within the lines, mixing of water from other wells, etc.

Large capacity wells which are "on-line" during the visit can be sampled immediately. Wells which are "off-line", must be pumped to waste prior to sampling. Fifteen minutes or more is suggested. Access to municipal well systems well houses, etc. requires the assistance of a water department employee. Prior notification is essential.

I. SAMPLING OF MUNICIPAL AND INDUSTRIAL WASTEWATERS

Sampling of municipal and industrial wastewaters is performed for a number of reasons: to determine compliance with Federal, State or local standards, to

verify reported self-monitoring data, to assist in determining discharger or user fees based upon wastewater strength, to verify the sampling technique and monitoring points of regulated parties, and to aid in determining the sources of prohibited or unwanted wastes. The most difficult type of sampling to perform is the collection of background information for future use; sometimes the correct information will be obtained, sometimes it will be missed. The collection of background information is critical. Information that may be gathered includes flow, totalizer readings, pH, TSS, treatment plant configuration and operating status.

When sampling wastewaters, one must take into consideration that good sample results are dependent on a number of factors, including sample representativeness, proper sampling technique and proper preservation. A location for sample collection should be chosen where uniform wastewater quality and thorough mixing exist. Wastewater influent samples should be collected at a point prior to any recycle, supernatant or return lines; wastewater effluent samples should be collected after the final treatment process. Take into consideration that the representativeness of samples may depend on timing; for example, influent samples collected at a municipal treatment plant with a substantial collection system may represent discharges into the system that occurred hours ago. In addition, be cognizant that many sampling locations present safety hazards, ranging from confined spaces, heights, unsteady equipment or surroundings, to airborne pollutants, biological hazards that may include infectious disease agents, ticks, poison ivy and snakes to chemical hazards such as corrosive liquids, heavy metals and potentially explosive atmospheres.

Samples may be collected as grabs or composites, depending on the purpose of the sampling, regulatory requirements or site conditions. Grab samples are single samples collected at neither a set time or flow. It may be advantageous to collect grab samples if wastewater flow is not continuous, if the wastewater's character varies or is not consistent, or if there is a need or desire to determine if a composite sample of the wastewater would obscure extreme conditions of the waste. In addition, some parameters, specifically dissolved oxygen or other dissolved gases, total and fecal coliform and other bacteria, pH, temperature, oil and grease and petroleum hydrocarbons, purgeable organics, and available and residual chlorine sulfite may only be collected as grab samples.

Composite samples may be collected in six different manners depending on sample volumes collected and at what frequency sample collection occurs. Composite samples may be collected as follows: constant sample volume/consistent time intervals, constant sample volume/time interval between samples is proportional to wastewater flow, constant time intervals/sample volume is proportional to the wastewater flow rate at the time of sample collection, constant time interval/sample volume is proportional to total wastewater flow since the last sample was collected; continuous sample collection or pumping rate, and continuous sample rate is proportional to wastewater flow. If flow rates at the time of sample collection are within (+/-) fifteen percent of the average flow, sample compositing based on constant sample volumes and constant time intervals is generally representative, however, the method is not considered to be the most representative for highly variable flow or concentration conditions. During sample compositing, a minimum of eight individual samples should be collected, if at all possible, and each individual aliquot should be a minimum of 100 milliliters. During six hour composites, a facility should collect an aliquot at least once each half hour.

Composite sampling may be conducted manually or by the use of an automatic sampler. The most common automatic samplers use either a vacuum pump or a peristaltic pump to draw the sample into the unit. A unit with a vacuum pump may be able to draw the sample at a higher velocity and from a cross-section of the wastestream, however it may also bias the solids concentration in the collected sample if the unit in use operates by filling a reservoir and then wasting excess sample material before draining the remainder to the sample container. A unit with a peristaltic pump discharges a measured sample volume into the sample container, so less solids separation and associated sample bias should occur. However, peristaltic pump units generally sample from only one point in the wastestream. Automatic samplers operating with a suction lift and without a detachable gathering system are practically limited to operation at heads at or under 25 feet due to internal friction losses and atmospheric pressure. Automatic samplers should be capable of rapidly purging the intake system prior to and immediately after collection of an aliquot. The transport lines for the units should also be at least 0.64 centimeters (0.25 inches) in diameter to prevent clogging. It should be recognized that the transport lines may build up growths which may periodically slough off and contaminate sample material if left uncleaned or unnoticed. Samplers should have an intake velocity of between two and five feet (0.6 to 1.5

meters) per second. Units with an intake velocity under two feet per second may leave solids behind in the tubing, while those with intake velocities over this range may draw in large pieces of suspended material; either case may yield erratic analytical results. One reference consulted recommended determining the suspended solids concentrations obtained from an automatic sampler and comparing it with a mean of a minimum of six simultaneously collected manual grab samples. The obtained ratio (automatic:grab) for a municipal treatment plant influent should be 1.6 to 2.0 and for a municipal treatment plant effluent should be 0.9 to 1.3. Samples should be kept near 4° C during compositing; if the sampler does not have an integrated refrigeration unit or ice compartment, it may be placed on ice in an ice chest that has been laid on its end. Standard Methods for the Examination of Water and Wastewater recommends the addition of chemical preservatives at the start of composite sample collection, so that all sample portions are preserved as soon as they are collected.

Units to be used for collecting samples to be analyzed for trace organics must be free of Tygon tubing, which may be a source of phthalate ester contamination, and of other sources of contamination such as plastic or rubber compounds. The collection of a field blank must include the automatic sampling equipment.

When sampling wastewater, any equipment coming in contact with the sample material must be clean (see Chapter 2). It is preferable to collect samples directly into the containers in which they will be submitted for analysis, if at all possible. If a bucket or sampling device is to be used for collecting samples that will be analyzed for metals, do not use a metal device. Some parameters, such as oil and grease, petroleum hydrocarbons, volatile organics, and base neutral/acid extractable organics should not be collected except in the final sample container, if at all possible. Any device or bottle coming into contact with the sample material should be rinsed with the liquid two or three times, unless the bottle is pre-preserved, contains a dechlorinating agent, has been rinsed with acid, acetone, or hexane, or unless the sample is to be analyzed for oil and grease, petroleum hydrocarbons or for microbiological parameters. Sampling devices should face upstream, and samples should be collected centrally (at a 0.4 to 0.6 depth from the bottom of the wastestream and in the center of the channel). Collecting samples at this depth avoids skimming the surface of the wastestream, where the concentration of lighter-than-water materials will be highest, and lowers the possibility of sampling bed

loads in situations where solids separation is a concern.

When sampling from a valve or a faucet, flush the sampling line first, taking into consideration the line diameter, length of pipe to be flushed and velocity of flow. When sampling wastestreams that are under pressure, regulate the flow rate in the sampling line to not less than 500 milliliters per minute after first flushing the line at a rate high enough to remove sediment and gas pockets. If it is believed that dissolved gases will be released from solution due to the drop in pressure, a notation should be made. If samples are to be collected from a wastestream that is at an elevated temperature, they must be collected through a cooling coil.

The importance of the use of proper containers and proper sampling and preservation techniques cannot be overly stressed. A material with a pH of 6.5 standard units, or less, and a low buffer capacity may experience a significant pH change if shaken. In addition, samples stored in plastic containers may experience a change in pH due to the permeability of the container walls to gases like carbon dioxide. With a change in the carbon dioxide, pH, and alkalinity balance, calcium carbonate may precipitate out and the concentrations of total hardness and calcium may drop. A change in the concentrations of carbon dioxide and dissolved oxygen and in pH and temperature may change the concentrations of inorganic parameters such as manganese, iron, alkalinity and hardness. If air contact will change the concentration or characteristics of a constituent, it is recommended that the sample bottle be completely filled and secured from air contact. If the sample will require mixing, if the sample will be completely consumed during analysis (such as oil and grease and petroleum hydrocarbons), or if microbiological parameters are to be analyzed, the bottle will not be able to be completely filled. If a preservative has already been added to the bottle, do not overfill the container. Containers should be completely filled for the following analyses: purgeable organics, hydrogen sulfide, free and residual chlorine, pH, hardness, ammonia, dissolved oxygen and oxygen demands, sulfite, acidity, alkalinity, ferrous iron, and for most organics. For samples requiring shipment, allow a one to ten percent airspace for thermal expansion except VO, BOS and DO. This airspace will most likely not compensate for accidental sample freezing, however.

Microbiological activity may be responsible for changes in the nitrate/nitrite/ammonia concentrations of a

wastewater, may reduce phenol concentration, may cause the reduction of sulfate to sulfide, reduce biochemical oxygen demand, and reduce residual chlorine to chloride. Due to oxidation, sulfite, sulfide, iodide, cyanide and ferrous iron concentrations may decrease. Hexavalent chromium may be reduced to chromic ion. Color, odor and turbidity may change in quality. Silica, sodium and boron may be leached out of glass containers. Some cations may be lost by adsorption onto, or in ion exchange with, the glass walls of sample containers.

Individuals who are required to chose dilutions for biochemical oxygen demand or coliform bacteria analyses, may find the following tables to be helpful:

Suggested Biochemical Oxygen Demand Dilutions

| Sample Type | Dilutions |
|--------------------|------------------------|
| Raw Sewage | 1-2-5X |
| Secondary Effluent | 5-10-25X or 2-5-10X |
| Tertiary Effluent | 5-10-25X |

Suggested Coliform Dilutions

| Sample Type | Dilutions |
|----------------------|--|
| Raw Sewage | 10 ⁻⁴ , 10 ⁻⁵ , 10 ⁻⁶ |
| Disinfected Effluent | 1, 10 ⁻¹ , 10 ⁻² |

| Dilutions | MPN Range |
|--|---------------------|
| 10, 1, 10 ⁻¹ | 2.0 1,600 |
| 1, 10 ⁻¹ , 10 ⁻² | 20 16,000 |
| 10 ⁻¹ , 10 ⁻² , 10 ⁻³ | 200 160,000 |
| 10 ⁻² , 10 ⁻³ , 10 ⁻⁴ | 2,000 1,600,000 |
| 10 ⁻³ , 10 ⁻⁴ , 10 ⁻⁵ | 20,000 16,000,000 |
| 10 ⁻⁴ , 10 ⁻⁵ , 10 ⁻⁶ | 200,000 160,000,000 |

J. POTABLE WATER SAMPLING

1. PUBLIC COMMUNITY WATER SYSTEM: DEFINITION

A system for provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serve at least 25 individuals at least 60 days out of the year.

a. Source (Raw water) Sample

i. Ground Water

Samples from a well supply should be collected as close to the well head as possible (before any treatment) preferably from a designated raw water sample tap. The sampler is cautioned to remember that well pumps and casings can contribute to sample contamination. If a well pump has not run for an extended period of time prior to sampling, the water collected may not be representative of actual water quality. The sample may be collected immediately (after flushing the sample tap) if the well has been running continuously. If the pump has turned off or is running intermittently, run the pump for a minimum of 30 minutes.

ii. Surface Water

Samples collected from a surface water supply are to be collected before the water receives any treatment and should be representative of the water entering the intake structure. The actual sampling location might be after the low lift pumps or at the intake structure. This sample is NOT to be collected along the banks of a river, lake, or reservoir.

b. Plant Delivered (Finished Water) Sample

This sample is to be collected at a location following all water treatment and is to be representative of the finished product leaving the treatment facility. Only proper spigots are to be used and they must be flushed prior to sampling.

c. Point of Entry Sample

This sample is to be collected at a point of entry into the water distribution system representative of a particular source after the application of any treatment.

In many cases this may be a plant delivered sample (if no other sample tap is available) or a meter pit sample tap where water bulk purchased from another water supply enters a distribution system.

d. System Sample

A system sample is a sample collected from the water distribution system. A FIRST DRAW sample is water that

immediately comes out when a tap is first opened. This type of sample is useful when evaluating whether plumbing materials are contributing lead or other contaminants to the water supply. A FLUSHED SAMPLE is collected after the piping has been evacuated and should be representative of the water flowing in the public water main.

When collecting a FLUSHED sample, allow the spigot to run long enough to obtain a representative sample. A good rule-of-thumb is to allow the water to flow until the water in the service line (the pipe that carries tap water from the public water main to a home or building) has been replaced at least twice. A convenient flow for sampling is usually about a half-gallon per minute. (to estimate flow, use a gallon jug and watch it fill: For a flow of a half-gallon per minute, the jug should be half full in one minute or completely full in two minutes). Since 50 feet of 3/4 inch service line pipe contains over one gallon (3.8 liters), 4 or 5 minutes of running time would be necessary to replace the water in the line twice.

Samples should not normally be collected from fire hydrants, drinking fountains, or from spigots that contain aerators or screens. If aerators or screens are present, they should be removed with care. Do not sample from taps that are surrounded by excessive foliage (leaves, flowers) or taps that are dirty, corroded, or are leaking. Never collect a sample from a hose or any other attachment to a faucet. Be sure that the sample container does not touch the faucet.

2. INDIVIDUAL WATER SUPPLY SYSTEMS (PUBLIC NON-COMMUNITY/NON-PUBLIC/DOMESTIC WELLS)

An important step when sampling these types of supplies is to conduct an initial survey to get a general overview of the water system and its operation, and how the configuration of the system relates to the type of sample (raw water, finished/treated water, or an intermediate sampling point) that you want to collect. Some important considerations are:

- Well driller and date drilled
- Construction of well and casing depth
- Well and pump location
- Well depth and pump capacity (if available)
- Storage tank capacity
- Treatment or conditioning units (if any)
- Plumbing arrangement
- Possible sample collection points
- Distance of well to any septic systems or underground storage tanks

Prior to sampling an individual water supply system it is essential to evacuate all standing water from the well, storage tank, and plumbing (unless a first draw sample is desired - See "System Sample"). A good rule-of-thumb is to flush for 15 minutes prior to sampling. Listen for the pump to turn on. This is a good indicator that the tank and plumbing are being evacuated. Opening additional faucets, flushing toilets, etc., will use more water and shorten the waiting time.

Should a raw water sample be desired, sample as close to the well head as possible and prior to the storage tank or any treatment system. Sometimes basement or outside faucets may be the best sampling point for this type of sample.

If the kitchen faucet is used, the aerator should be removed (for more information see H 5.h. Sampling Domestic Wells).

K. BIOLOGICAL

1. PHYTOPLANKTON SAMPLING

a. Sample Site Location

Locate sampling stations as near as possible to those selected for chemical and bacteriological sampling to ensure maximum correlation of findings. These locations will depend upon the physical nature of the water body. In streams or rivers, stations should be established both upstream and downstream of a pollution source or major tributary. Stations should also be set up on either side of the river so as to account for unequal lateral mixing. Slow moving sections of streams generally contain more phytoplankton than slower moving segments. If there are any lakes, reservoirs, or backwater areas (i.e., potential phytoplankton sources) upstream of sampling stations, notes on their nature and location should be included in the sampling log.

Sampling stations in lakes, reservoirs, estuaries and the ocean should be located along grid networks or transect lines, aligned so as to provide the most representative sampling. Points of interest should include intake and discharge areas, constrictions within the water body, and major bays and tributaries off of the main basin. In tidal areas, the effects of tidal oscillation should also be taken into account

when determining sampling frequency. When locating stations for a "red tide" survey in estuarine or coastal waters, note where and when the blooms tend to occur.

b. Sampling Depth

Rivers, streams, shallow bays and coastal waters are usually well mixed so that only subsurface sampling is necessary. In lakes, reservoirs, as well as deeper coastal waters, plankton composition and density may vary with depth; thus sampling should be done at several depths determined by the depth of the thermocline, the euphotic zone if applicable, and overall the depth at the station. In shallow areas (1-2 meters) subsurface samples (to a depth of 1M) are usually sufficient. In deeper lakes and reservoirs, samples should be taken at intervals of 5M or less to the thermocline. In estuarine and coastal waters 2-10M deep, subsurface, mid-depth and near bottom samples are recommended. Offshore, in marine waters, samples should be collected at intervals of 5M or less to the bottom of the thermocline, and near the bottom where depletion of oxygen by decaying blooms is critical; larger sample volumes of at least one liter are needed because these waters are typically low in productivity.

c. Sampling Procedure

Sample size, preservation and storage is dependent upon certain variables. Refer to Appendix 2-1 for details.

If analysis is limited to species composition clear polyethylene or glass bottles may be used. If chlorophyll analyses is requested, amber bottles are recommended. Clear or translucent glass or plastic bottles may be used provided they are covered with aluminum foil so as to shield out light.

Freshwater samples for species composition analysis should be preserved with a solution of neutralized formalin (5 ml neutralized buffer with formalin/100 ml of sample); estuarine and marine samples are to be preserved with Lugol's solution (60 g KI + 40 g iodine crystals in 1,000 ml distilled water) at a rate of one (1) drop Lugol's solution to 100 ml of sample adding more periodically to maintain the color of weak tea. In special studies glutaraldehyde may be used (6 drops/25 ml of sample). All preserved samples should be stored in the dark immediately so as to prevent the degradation of the phytoplankton, or the preservative if Lugol's solution is used.